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HARVESTING
GRAIN SORGHUMS



GROWERS of grain sorghums desire methods of harvesting which require little hand labor. The nonuniformity in height and maturity of most grain-sorghum fields increases the difficulty of harvesting. Milo bears many of its heads on recurved stalks, making harvesting difficult.

The methods used in harvesting grain sorghums are hand heading, row binding, machine heading, and combining.

A man with a team and wagon will head by hand an average of about 1.8 acres per day.

A man with a four-horse team can harvest an average of 7 acres per day with a row binder (corn binder). One man can shock about 5 acres of bound grain sorghum per day.

Two men can harvest and rick about 13 acres per day with a grain header. Six horses or mules are required to pull the header, and two to four horses are needed for pulling the header barge.

A man and team with a wagon-box header will harvest about 4 acres of kafir per day.

Two men with a 15-foot combine harvest and thresh 20 to 25 acres of grain sorghum per day.

Five men with a separator can thresh about 1,100 bushels of headed grain sorghum per day.

Harvesting and threshing machines require special adjustments in order to handle grain sorghums satisfactorily.

Grain sorghums frequently are damp when threshed and should be dried by leaving the grain in small piles on the ground or on bin or barn floors before it is stored or shipped.

The method of harvesting followed should depend upon the equipment and labor available and the expected disposal of the crop.

HARVESTING GRAIN SORGHUMS¹

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PROBLEMS OF HARVESTING GRAIN SORGHUMS²

GRAIN SORGHUMS are grown mostly in the southern Great Plains, an area of extensive farming. (Fig. 1.) The yields frequently are low, and the crop must be harvested economically. Growers desire methods of harvesting which require little hand labor. Special machines have been devised, and grain headers and harvester-thresher combines frequently have been used in order to reduce the labor of harvesting and threshing grain sorghums.

Harvesting and threshing grain sorghums is hindered by the irregularity in the ripening and drying of the crop. The heads frequently mature while the stalks and leaves are still green and juicy. Ripening of the plants is seldom uniform. The heads on the suckers usually ripen after those on the main stalks. The grain becomes damp from moisture squeezed out of the stalks if the heads are threshed before the stalks are dry. Immature grain contains considerable moisture when harvested. Threshed sorghum grain frequently goes out of condition during storage. Frequently many kernels are cracked in threshing, and a considerable proportion of cracked grain increases the danger of spoiling in the bin.

¹ The information contained in this bulletin is based chiefly upon a survey of the methods of harvesting grain sorghums used in southwestern Kansas and western Oklahoma in the fall of 1926. This survey was conducted jointly by the Bureaus of Agricultural Economics, Public Roads, and Plant Industry of the United States Department of Agriculture, the Kansas Engineering Experiment Station, and the Kansas and Oklahoma Agricultural Experiment Stations.

² For information concerning the varieties and methods of growing grain sorghums, see ROTHGEB, B. E. GRAIN SORGHUMS: HOW TO GROW THEM. U. S. Dept. Agr., Farmers' Bul. 1137, 26 p., illus. 1920.

Grain sorghum heads on lodged stalks can not be harvested successfully by machinery. When the sorghum stalks become dry after ripening or freezing they are blown over easily.

Harvesting with machines is very wasteful if the crop is of uneven height, as is frequently the case. Pure varieties and good seed-bed preparation aid in obtaining uniform stands and growth. Hybrid or "bastard" stalks interfere seriously with harvesting by machinery. The selection of heads typical of the variety from isolated fields for seed will largely eliminate the hybrid plants in the following crop. Some grain-sorghum varieties shatter easily when allowed to stand for several weeks after maturity.

The ordinary Dwarf Yellow milo is not well adapted to harvesting by machinery because of stalks irregular in height, "goosenecked" heads, late "sucker" heads, and the frequent lodging of the stalks

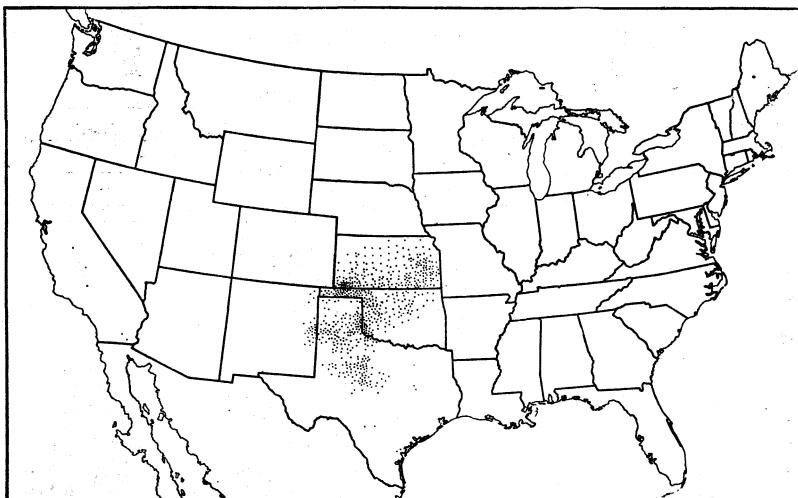


FIG. 1.—Outline map of the United States showing the distribution of grain sorghums in 1924. Each dot represents 5,000 acres

after ripening or freezing. Much of the milo, therefore, is headed by hand. A new variety having erect heads and known as Straight-neck milo has been developed recently. This variety can be harvested more easily than the ordinary Dwarf and Standard milos unless the stalks lodge, but the stalks of the Straight-neck variety are extremely susceptible to lodging.

Kafir is more easily harvested by machinery than other grain sorghums because of its erect heads and stiff stalks. The Dawn (Dwarf) kafir matures early and has short stalks and probably is the variety most easily harvested. Hegari is harvested about as easily as kafir. Feterita usually is too tall and too irregular in height for successful machine heading, and the stalks also are inclined to lodge.

METHODS OF HARVESTING

The methods by which grain sorghums are harvested are hand heading, row binding, cutting with grain header, combining, and such

miscellaneous methods as cutting with the wagon-box header and grain binder. When the stover is desired for feed the crop usually is cut with the row binder. This is the usual method of harvesting in the mixed-farming districts of southeastern Kansas and other sections where grain sorghums as a rule are not chiefly a commercial grain crop. Where grain sorghums are grown only for grain the crop is headed by hand or with machines or is combined. These various methods and machines have certain advantages, disadvantages, and limitations.

HAND HEADING

Hand heading, called also topping or picking, is the most common method of harvesting milo. Other grain sorghums frequently are harvested by hand also. The heads are cut from the stalks with a knife and thrown into a wagon. The type of knife generally used is illustrated in Figure 2. The wagons, equipped with boxes and "bump board" or simply with header barges or hayracks, are drawn along the rows. Hand heading is somewhat comparable to husking corn from standing stalks. The heads are grasped in one hand and the stalks cut with the knife at a distance of 2 to 7 inches below the bases of the heads. Usually several heads are cut off and held in the hand before being thrown into the wagon. Two rows usually are harvested in one trip across a field. A view of hand heading is shown in Figure 3.

The loads of heads are pitched on the ground in long, low, narrow ricks or windrows about 3 to 4 feet high and 4 to 7 feet wide at the bottom. These ricks usually are left to dry in the open until threshed. A rick of hand-headed milo is shown in Figure 4.

A man with a team and wagon will head by hand and dump in ricks an average of about 1.8 acres, or 35 bushels, of grain sorghum per day from fields yielding 20 bushels per acre. One man can thus harvest about 45 acres in 25 working days. When the farmer or members of his family do the harvesting no cash outlay is necessary. Where the work is all hired and man labor costs \$2.75 and horse labor 40 cents per day, the average cost of harvesting by hand is about \$2 an acre, or 10 cents a bushel. The cost of threshing hand-headed milo is about 4 or 5 cents a bushel in addition, as compared with 6 or 7 cents when cut with the grain header.

The chief advantages of hand heading are that harvesting can begin early while the stalks are still green, harvesting losses are practically negligible, extra equipment is not required, and small acreage can be harvested without hiring extra help. Also, the short stalks do not interfere with the feeding or marketing of the grain in the head. The disadvantage of hand heading is the large amount of labor required.

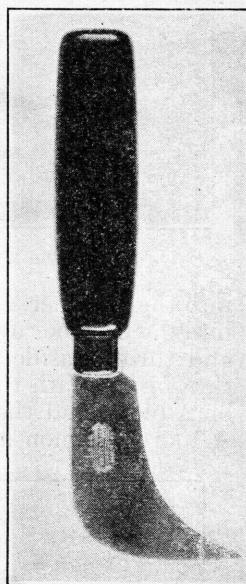


FIG. 2.—Knife used for heading grain sorghums by hand

BINDING

The row binder (corn binder) is used chiefly for harvesting kafir where the stover is desired for feed. Much of the kafir, feterita, and other grain sorghums which are harvested with the row binder are fed in the bundle. The bundles are placed in shocks similar to those of corn. A row binder in operation is shown in Figure 5.

Several methods can be used for threshing grain sorghums cut with the row binder. By one method the bundles are fed completely

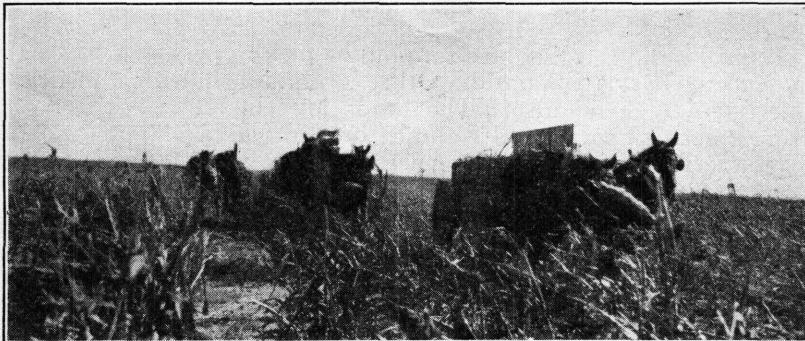


FIG. 3.—Heading grain sorghums by hand with a crew of three men and teams

into the thresher. By another, only the heads of bundles are pushed into the thresher cylinder and the stalks of the bundles are withdrawn and thrown aside. The heads also may be removed first and then threshed. With the latter method the bundles frequently are placed on a block and the heads chopped off with an ax or a heavy knife. A more common and better way is the use of the so-called "cheese



FIG. 4.—A rick of milo headed by hand

knife," shown in Figure 6, which consists of a long blade and lever handle mounted on the side of a wagon. The wagon is driven beside the shock, the bundles are placed under the knife, and the heads are sheared off by a man standing in the wagon who pushes down the lever. The severed heads fall into the wagon and either are hauled directly to the thresher or are piled in ricks until threshed.

Some combine manufacturers make a special sickle which operates with the sections in a vertical position to cut the heads from the

sorghum bundles. (Fig. 7.) The sorghum bundles are laid across the sickle, and the heads are cut off, dropped on the combine-platform canvas, and carried into the threshing cylinder. Combines equipped



FIG. 5.—Harvesting kafir with a row binder

with this sickle usually are pulled up to sorghum shocks, where the heads are cut off and threshed and the stover is reshocked by the men. This method saves labor but necessitates the use of expensive equipment.

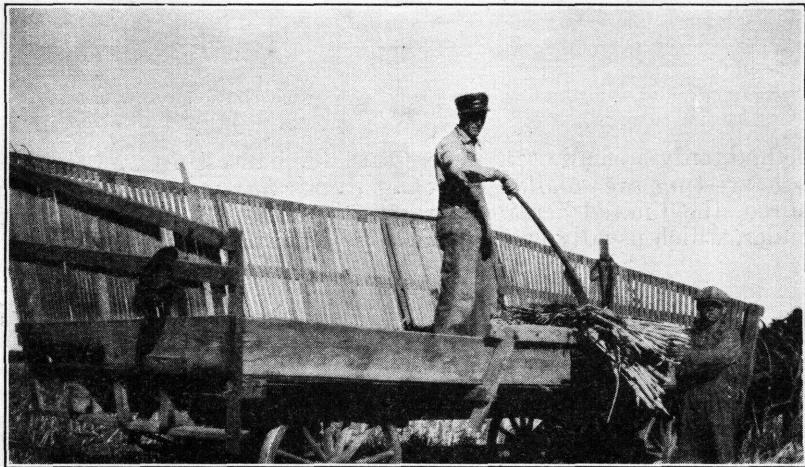


FIG. 6.—Heading bundles of kafir with a "cheese knife"

A man with a three-horse or four-horse team can harvest an average of 7 acres a day with a row binder. One man can shock 5 acres of bound grain sorghum a day. The maximum acreage which can be harvested with a row binder is about 160 acres per season.

Usually this machine is used for harvesting small acreages. When the labor and horses are hired, with man labor at \$2.75 and horse labor at 40 cents a day, the average cost of harvesting grain sorghums with a row binder and shocking the bundles is about \$1.20 per acre. This is equivalent to a cost of 6 cents a bushel for a 20-bushel acre yield.

Additional labor is necessary for hauling and topping the bundles when they are threshed with a separator. The total cost of harvesting and threshing a crop with hired labor by this method is about 13 cents a bushel.

The advantages of harvesting with the row binder are that the stover is saved, harvesting can begin earlier than by any other



FIG. 7.—Heading and threshing bound kafir with a combine equipped with a vertical-sickle attachment

method, only a small crew is necessary for harvesting, and the losses in harvesting are small. The chief disadvantages are the labor required, the limited acreage harvested per day, and the cost of the binder, which usually is not owned by the farmer.

CUTTING WITH THE GRAIN HEADER

The grain header has been used for harvesting grain sorghums, especially kafir, for many years. With the exception of hand heading it is the most common method of harvesting grain sorghums that are to be threshed. The heads, together with the upper part of the stalks, sometimes as long as 24 to 30 inches, are cut off and elevated to the barges. The heads usually are dumped from the barges into ricks and left until ready to thresh. Some farmers haul the heads directly to the thresher from the header. The curing and threshing of sorghums cut with the header is the same as when cut by hand except that there is more stalk to be handled. The use of the header in harvesting grain sorghums is illustrated in Figures 8 and 9.

The operation of cutting grain sorghums with the header does not differ materially from wheat heading except that less care is necessary in loading the header barges, and the ricks are smaller and more easily built than wheat stacks.

A crew of 2 men with a header can harvest and rick an average of about 13 acres of grain sorghum per day. At this rate 260 acres could be cut in 20 working days. Six horses are required to pull the header, while the barge is pulled by two to four horses. With a 2-man crew the header stands idle while the barge is being unloaded by both men. The driver of the barge does little or no loading by hand. An average of 16 acres or more can be harvested by a 3-man crew using 1 or 2 barges. When 1 barge is used by a 3-man crew the third man arranges the heads, so that large loads can be hauled. With 2 barges each driver pitches off his own load unaided, and little hand loading is done. More than 3 men do not seem to be

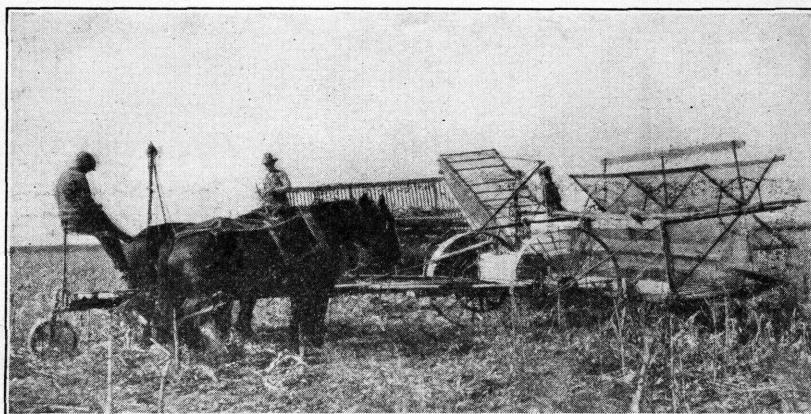


FIG. 8.—Harvesting kafir with a grain header

desirable for one header, as the acreage of grain sorghums harvested per man per day is less with crews of more than 3 men.

Grain sorghums can be harvested with no cash expense except for repairs and lubricants by farmers who own a header and eight horses and have another member of the family capable of driving a header barge. The average cost for man and horse labor, where both are hired, of harvesting grain sorghums with a header and two men is about 70 cents an acre. With a 20-bushel yield the cost is 3½ cents a bushel. The cost of threshing grain sorghums cut with the header is 6 to 7 cents a bushel with a custom thresher, making the total cost of harvesting and threshing by hired labor about 10 cents a bushel.

The advantages of the header as compared with the hand and row binder methods of harvesting are in the saving of labor and in increasing the acreage harvested per day. The disadvantages are the additional cost of threshing, because more stalk must be put through the machine, and the greater losses of grain in harvesting. The average losses during heading are about 6 per cent of the total yield of kafir and 14 per cent of the yield of milo. With 20-bushel yields

the average losses are 1.3 bushels of kafir and 2.7 bushels of milo. At 1 cent a pound for the grain these losses would nearly offset the saving in harvesting costs over the hand method with kafir and more than offset the savings with milo. If the losses are sufficiently reduced by proper adjustments of the machine, or the loose heads are picked up, or the fields are pastured, the header is considerably more economical than the hand method for harvesting kafir and probably equally economical for harvesting milo.

Parts of headers need to be changed for harvesting grain sorghums to avoid serious losses. Extra slats or screen wire should be bolted to the reel arms, and wire mesh should be fastened at the back and end of the cutting platform. A header so equipped is shown in Figure 9. These alterations reduce the number of heads that are

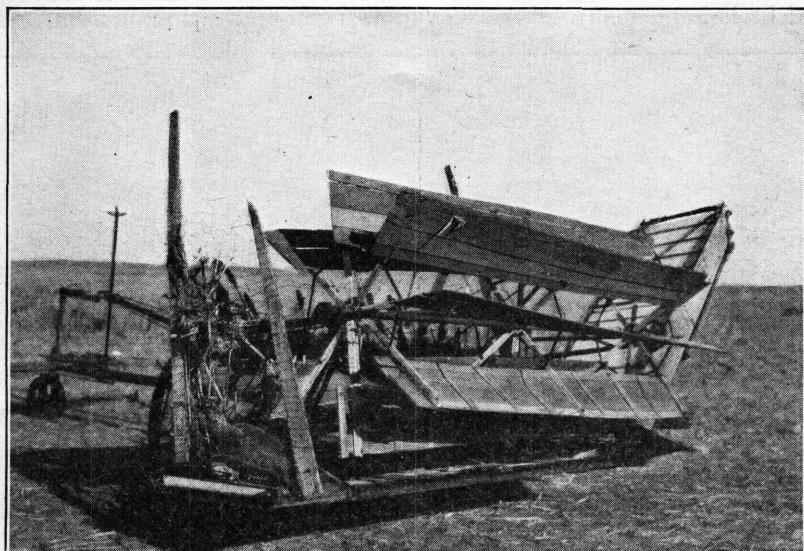


FIG. 9.—Extra reel slats and wire screen on a grain header used for harvesting kafir

thrown out by the reel. The platform can be raised on headers by bolting on the supporting arms upside down or in a different position on the header frame. The bottom of the reel slats should just clear the cutter bar. On uneven fields this is not possible, because the reel must be raised or many of the taller heads would be missed. If the top of a head on a standing stalk is above the axle of the reel the stalk will be knocked over by the reel instead of being pushed into the sickle. The cutter bar should be raised to a point just below the heads on the short stalks.

COMBINING

The latest method of harvesting grain sorghums is with the combine. Until recently it had been thought that the combine would not be practicable, because the sorghum stalks contain considerable moisture when the seeds reach maturity. A few farmers began using the combine for harvesting grain sorghums, however, about six years ago. Its use is increasing rapidly in spite of certain mechanical

limitations of the machine for harvesting grain sorghums and the disadvantages of handling and storing damp grain. A view of a combine harvesting milo is shown in Figure 10.

Harvesting sorghums with the combine should not begin until most of the plants are mature. The threshed grain usually is damp unless the stalks are dry at harvest. Many farmers wait until after frost before starting with the combine.

The 15-foot and 16-foot tractor-drawn combines usually require one man on the combine and another to drive the tractor. An additional man with truck or team and wagon is needed to haul the grain, unless the combine is stopped after each load is threshed. The horse-drawn combines usually are operated by two men. The smaller 8-foot and 10-foot power take-off combines can be operated by one man who also drives the tractor. A 15-foot combine will cut an average of $2\frac{1}{2}$ acres an hour, or 20 to 25 acres a day. Combines harvest less

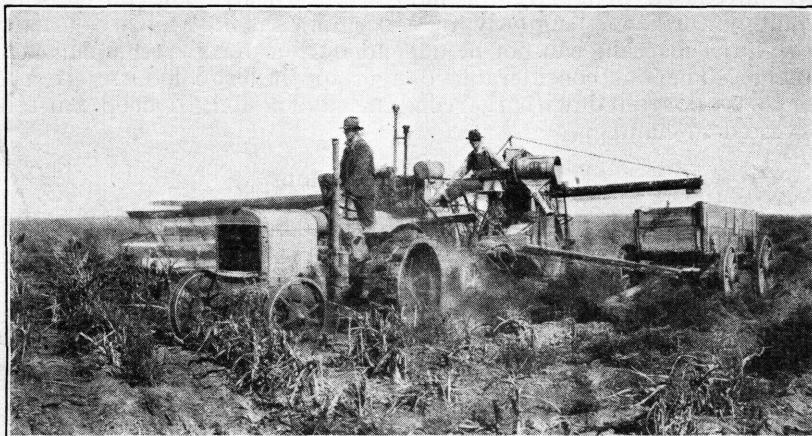


FIG. 10.—Harvesting milo with a combine

grain sorghum than wheat per day on the average because of the difference in the crops. Harvesting sorghums involves more machine repairing, more frequent choking of the machine, shorter days, and frequently a slower rate of travel than in cutting wheat. The slower rate of travel is due to the roughness of sorghum fields planted with a lister. Harvesting grain sorghums is considered nearly twice as hard on the combine as harvesting wheat. The cost of labor, power, and fuel for harvesting and threshing grain sorghums with a tractor-drawn combine averages about 65 cents an acre. With a 20-bushel yield the cost is about $3\frac{1}{4}$ cents a bushel. About 1.6 gallons of fuel and 0.1 gallon of oil per acre are consumed by the tractor and combine engines in harvesting grain sorghums. The combine is very economical of labor, which is its chief advantage.

The average proportion of heads left in the field in harvesting with a combine is about 11 per cent for kafir and 26 per cent by weight of the total crop of milo, as determined in 58 fields in 1926. These percentages are equal to 2.2 bushels of kafir and 5.2 bushels of milo yielding 20 bushels per acre. The number of heads left in the field can be reduced materially by proper adjustments of the combine.

The heads dropped also are sometimes picked up, or the fields can be pastured, which reduces the loss. The cost of harvesting and threshing grain sorghums with the combine is less than harvesting by hand even if the losses are 3 bushels per acre.

The adjustments of the reel and cutter platform necessary to reduce harvesting losses with the combine are the same as with the header. If the combine is so adjusted the harvesting losses are no greater than with the header. The platforms of some makes of combines can be raised by bolting iron stilts between the platform and the supporting arm, and on other makes by changing the position of the platform brace rods. Some delays in harvesting occur because of long stalks choking the feeder canvases.

The adjustments to be made in the threshing parts of the combine are described later under threshing.

All combines that have been used for harvesting grain sorghums were purchased primarily for harvesting wheat. The purchase of a combine for harvesting only grain sorghums is not justified, usually because the machine can not be depended upon to harvest a sufficient acreage. There is considerable danger of the crop lodging if it is left to be harvested with the combine, and a lodged crop must be harvested by hand.

MISCELLANEOUS METHODS

Other methods of harvesting grain sorghums include cutting with a grain binder and with special kafir headers. Grain sorghums, especially those with short, slender stalks, can be harvested with a grain binder. This usually is done with a crop that is stunted by drought or poor soil. Cutting sorghum stalks is a heavy strain on the binder.

Two general types of kafir headers have been devised. These are the one-row and two-row machines. The one-row headers are attached to a wagon box and driven by a chain from a sprocket attached to a rear wagon wheel. The wagon is driven along a row while the heads are cut off and elevated into the wagon. (Fig. 11.) These machines do good work in fields of kafir and other erect-headed sorghums having stalks that are erect and uniform in height, but the harvesting losses would be too great if milo or any other irregular crop were harvested with the wagon-box header.

A man and team with a wagon-box header will harvest about 3 to 5 acres a day. The cost of hiring man and horse labor for harvesting at the rate of 4 acres a day is about 90 cents an acre, on the same wage basis as was used in estimating the expense of other methods of harvesting. This is more economical than hand heading and also more rapid. The cost of a wagon-box header is small, and a farmer who has one can harvest his own crop of kafir more easily than by hand and about twice as rapidly.

The objections to a wagon-box header are that it harvests only one row at a time, is hard on the wagon, can not be used for harvesting milo or other uneven or "nodding" sorghums, and does not harvest the heads from leaning or lodged stalks. Because of these numerous drawbacks this type of header is used to only a limited extent, although it has been manufactured for many years.

Several two-row headers have been devised, patented, and used, but none has yet become of commercial importance. These machines have little or no advantage over a well-adjusted grain header. Some of them, however, will do clean harvesting in good uniform fields. They are less satisfactory than the grain header for harvesting milo. They cut only two rows at a time instead of the three or four rows cut by a grain header and also require an additional investment, because they can not be used for harvesting other grains.

THRESHING

Grain sorghums harvested with the combine are threshed during the same operation. Much of the grain sorghum cut with the row binder and by hand is fed without threshing. The heads are fed

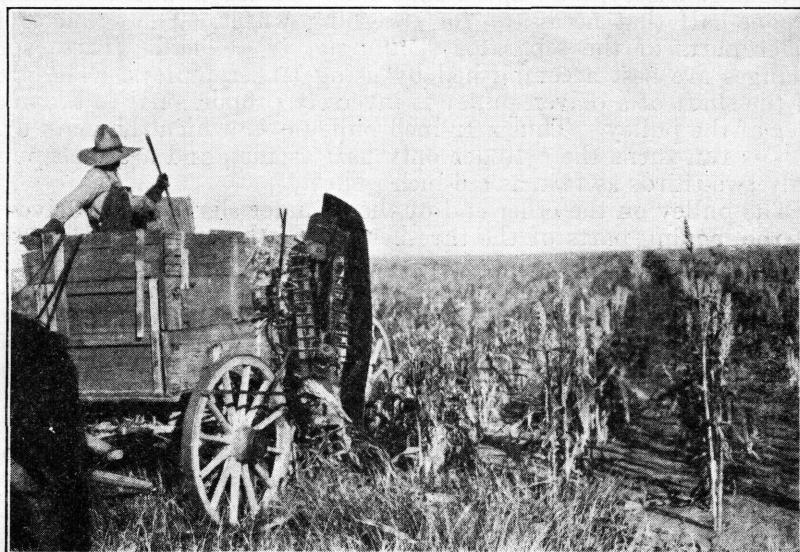


FIG. 11.—A one-row kafir header attached to a wagon box

either whole or ground, preferably the latter. A considerable quantity of hand-headed material is marketed in that form. Large quantities of grain sorghum are threshed, however, not only for the market but for feeding hogs and poultry on the farm. Two principal types of machines are used for threshing harvested grain sorghums. These are the grain separator or thresher and the combine.

USE OF THE GRAIN SEPARATOR

The ordinary grain separator has long been used for threshing grain sorghums. The method of feeding the machine depends upon the method of harvesting the crop. Usually the separator is provided with a portable extension feeder which is placed along the ricks of heads. The heads are then pitched into the feeder by hand. Most of the ricks are rather small, and frequent moving is necessary. About three-fourths of the weight of hand-headed grain sorghum

is grain. Most of the crop cut with the row binder, to be threshed later, is headed by hand before threshing, so the method of feeding is the same as in hand-headed or machine-headed grain. Occasionally whole bundles are fed into the separator, but this places a heavy strain on the machine and gives trouble by choking unless the crop is light and the stalks small. Sometimes the bundles are held by hand with the heads in the cylinder while the grain is being knocked off, after which the stalks are withdrawn and thrown aside.

The adjustments necessary for the good threshing of grain sorghums depend upon the kind and condition of grain being threshed. The drier the grain the more easily it is cracked. Feterita is cracked more easily than milo and milo more easily than kafir. Some varieties of kafir, such as Reed, are difficult to thresh free from the tightly inclosing chaff, while other varieties are threshed clean with ease.

Usually the cylinder speed should be reduced to about two-thirds or one-half that necessary for threshing wheat. The speed of the other parts of the separator should not be reduced. These speed changes are best accomplished by using larger pulleys. The speed of the shaft of a driven pulley is inversely proportional to the diameter of the pulley. Thus a 12-inch pulley over which the main drive belt is run turns the cylinder only half as fast, and a 9-inch pulley only two-thirds as fast, as a 6-inch pulley.

The pulley on the other end of the cylinder shaft which drives all of the moving parts of the thresher except the cylinder also should be changed for a larger pulley. It should be as much larger than the smaller one as the new main belt pulley is larger than the old one.

Usually all but one or two rows of concave teeth should be removed, depending upon the condition of the grain. Occasionally the concaves need to be lowered in order to reduce cracking. The spaces between the cylinder and concave teeth should be uniform.

The sieves and screens used in threshing wheat can be used for grain sorghums also, but special straw racks are provided by some threshing-machine manufacturers for use in threshing grain sorghums.

USE OF THE COMBINE

Nearly as much headed and bound grain sorghum is threshed with combines as with separators in localities where combines are numerous. A combine threshing headed milo is shown in Figure 12. The reel and sickle are removed from the combines used as stationary threshers. Some machines are equipped with straw carriers or stackers with endless belts such as formerly were used on threshing machines in place of the present wind stackers. A straw carrier entirely eliminates the pitching of the stover or threshed stalks, as the combine is moved forward before a large stack accumulates.

All but one or two rows of concave teeth should be removed for threshing grain sorghums in order to prevent cracking of grain. The concaves should be lowered on all machines having the bar or rasp type of cylinder and concaves, and sometimes on machines having teeth in the cylinder and concaves. The cylinder speed also should be reduced to about two-thirds or half that required for threshing wheat to avoid cracking grain. The speed of the cylinder

is reduced by loosening the governor spring to slow down the motor and by putting a smaller pulley or sprocket on the motor. Special sprockets which permit the speed of the cylinder to be greatly reduced without affecting the normal speed of the other moving parts can be procured from most combine manufacturers. The proper speed of shakers, beaters, chaffers, sieves, and fans facilitates separation of the grain from chaff and straw.

Combines equipped with recleaners are preferable because the fine cracked grain is removed.

The stalks, leaves, and heads of grain sorghums usually contain considerable moisture when harvested. This wet material or "pomace" frequently is chopped up so that it falls through the straw racks and is too heavy to be blown out with the chaff. Consequently much of the pomace is repeatedly returned to the cylinder by the tailings elevator until it is ground fine enough to pass out with the

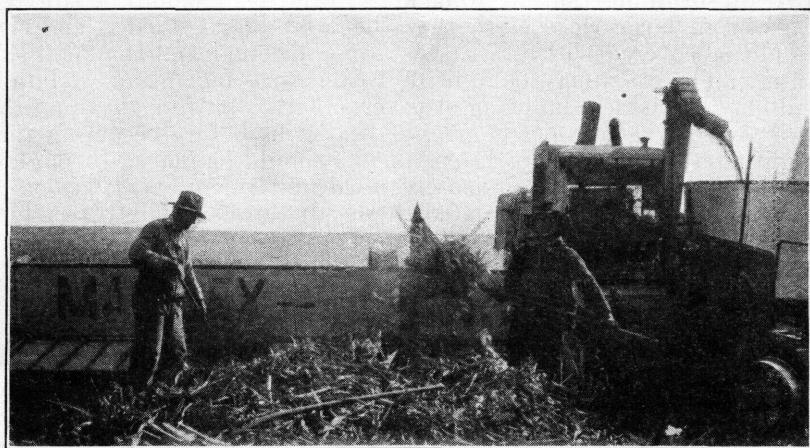


FIG. 12.—Threshing headed milo with a combine

grain. Its presence in the grain increases the danger of heating. To avoid this difficulty a piece of sheet metal should be placed over the space between the chaffer and the tailboard to prevent the pomace from falling into the tailings chute. The fewer tailings that are returned to the cylinder the less cracked grain there will be. Wasting the tailings increases the efficiency of threshing much more than enough to offset the value of the small quantity of grain lost. Excessive tailings frequently choke the tailings elevator and cause the breaking of chains and sprockets or the slipping of belts.

Less grain per day is threshed with a combine than with the larger separators, but a smaller crew is used, so that the quantities threshed per man are about the same. An average of more than 200 bushels per man per day can be threshed. There is little difference in the cost of hiring grain sorghums threshed by combines or separators. Combine owners, however, can reduce the cost of threshing their grain sorghums by using their combines instead of hiring a custom separator.

STORING GRAIN SORGHUMS

A satisfactory and common form for storing grain sorghums is in the bundle. The shocks can be left in the field until both the grain and the stover are thoroughly dry, and then the bundles can be placed in larger ricks or stacks. If properly stacked the bundles shed water well and few of the heads are exposed to the weather. Grain sorghums can be kept in bundles for several years without serious deterioration from weathering.

STORING HEADS

Grain sorghums harvested by hand or with a header are stored in ricks like those shown in Figure 4. These ricks usually are left only until the heads are dry, as much of the grain will spoil if left until spring.

Grain sorghums that are to be kept in the head should be stored in cribs or in large ricks as soon as the heads have dried. The ricks should be covered with grass, straw, or other material that will shed water. The cribs may be built of woven-wire fencing or of lumber and may be inside a building or covered with a roof or anything that sheds water. If the heads are put into cribs before becoming thoroughly dry, fence posts or large timbers should be placed throughout the crib to keep the heads loosely piled and permit ventilation. If the cribs are properly ventilated the heads can be put in direct from the field at harvest time.

STORING THRESHED GRAIN

Threshed grain usually contains from 11 to 15 per cent of moisture, but it sometimes contains as much as 18 to 20 per cent. Grain containing more than about 13 per cent of moisture is in danger of spoiling during warm weather. Grain with a high moisture content will spoil in any kind of weather. The keeping quality of the grain depends not only upon the moisture in the grain but also upon the temperature and humidity of the air and the proportion of foreign material and cracked kernels in the grain. Recleaned grain will keep much better than grain containing cracked kernels and bits of sorghum leaves and stalks. Grain sorghums frequently keep well during the winter, but go out of condition with the approach of warm weather.

The heads should not be threshed until the grain feels dry when held in the hand. The threshed grain should be as free from cracked kernels and foreign material as it is possible to make it.

DRYING GRAIN

Grain sorghums harvested with a combine necessarily contain considerable moisture. This can be reduced by properly drying the grain. The most common and easiest method of drying is to place the grain on the ground in piles about $2\frac{1}{2}$ feet high and 6 feet wide, as shown in Figure 13. The slope of the pile of grain exposes much of the grain to the air and also tends to shed rain. A pile of this sort can be examined easily by pushing the arm into the bottom to determine whether the grain is heating. Any part of the pile that is heat-

ing can be spread out with a scoop and permitted to dry. A canvas spread over the pile will protect the grain from rain.

Bins equipped with ventilators have been suggested for storing damp sorghum grain.³ In general, ventilated bins have proved effective for keeping grain which is only slightly damp, but they are not a practical means of drying grain which is distinctly wet. The ventilators recommended consist of long narrow wooden box frames with window screens across the top, bottom, and both ends. These were placed across the bins with the ends fitted into openings in the bin walls. A few of these ventilators sometimes have been placed in a vertical position with their bases resting on cross ventilators. The grain near the ventilators is partly dried by air passing through the ventilators, but there is very little circulation of air through the grain itself.

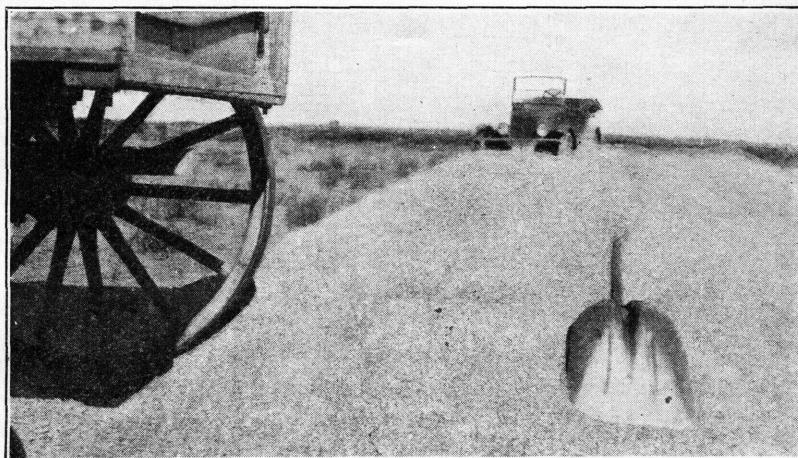


FIG. 13.—Milo threshed with a combine, piled on the ground to dry

Combine milo harvested under dry conditions in the San Joaquin Valley of California keeps well in the bags which are dropped on the ground in the field.

UTILIZATION OF STOVER

The stover of grain sorghums cut with the row binder usually is fed in the bundle. The stover of grain sorghums that have been headed seldom is harvested. The only use made of the stalks is for pasture. Farmers estimate the average value of the pasture from machine-headed fields at about \$1 an acre. Many heads are left in the field after careless harvesting. An average of about 2.5 bushels per acre was gathered from a large number of the fields harvested with the header and combine in 1926. A man and team can pick up these

³ A description and illustration of this type of bin is presented in ROTHGEB, B. E. MILO, A VALUABLE GRAIN CROP. U. S. Dept. Agr., Farmers' Bul. 1147, 19 p., illus. 1920. A copy of this bulletin can be obtained upon request to the U. S. Department of Agriculture, Washington, D. C.

heads left on the ground at the rate of about 13 bushels of grain per day. If sufficient livestock are kept on the farm the heads left in the field are gathered quickly by the animals with very little loss and no expense. Unfortunately, only a few animals usually are kept on the farm producing grain sorghums for the market.

There is some risk in turning stock into sorghum fields before the plants are dead and dry, because of the formation of prussic acid, a deadly poison, in young, stunted, or frosted sorghum plants.

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